

REMARKS

Claims 1, 4-10: 35 U.S.C. § 103(a) - Tsuya-Okase

Claims 1 and 4-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tokai et al. (US 6,566,199) in view of Okase (US 5,749,723).

The applicant respectfully traverses the rejection. The office action asserts that Okase discloses introducing the substrate which bears the layer stack into a holding device, introducing the holding device into a heating device, passing an oxidation gas onto the substrate, heating the substrate to a process temperature, the layer which is to be oxidized, as the oxidation time continues, being oxidized ever further from an edge into the layer stack under the influence of the oxidation gas at the process temperature, recording the process temperature during the processing by recording a temperature of the holding device, and controlling the temperature of the substrate to a predetermined desired temperature or a predetermined desired temperature curve during the processing.

While it is not clear from the office action which disclosure of Okase is relied upon to disclose the holding device feature, Okase does not disclose a holding device into which the substrate is introduced, and which is introduced into a heating device, where the process temperature is recorded by recording the temperature of the holding device. The process temperature in Okase is recorded as the temperature of the atmosphere within a reaction tube 1 (Okase, col. 4, lines 1-13). Accordingly, the Tokai-Okase combination does not disclose all the features of claim 1 and the claims that depend from claim 1.

The Applicant respectfully submits that the Tokai-Okase combination does not disclose the features of claim 4. According to claim 4, the process temperature is between 350°C and 450°C. Further, according to claim 4 the process temperature is the temperature at which the layer is oxidized. The office action points to Okase, col. 3, lines 55-67 through col. 4, lines 1-13 to disclose the features of claim 4. The process temperature in the cited portion of Okase, as well as throughout the reference is not between 350°C and 450°C. In Okase, the temperature at which oxidation occurs between 800°C and 1200°C (Okase, col. 4, lines 1-16). In Tokai, the film-forming

temperature is between 800°C and 1100°C (See Tokai, col. 12, lines 5-7; col. 22, lines 33-34; Figs. 5-9). Accordingly, the Tokai-Okase combination does not disclose all the features of claim 4.

The Applicant respectfully submits that the Tokai-Okase combination does not disclose the features of claim 5. Claim 5 includes, *inter alia*, a preheating step in which the temperature in the heating device is held, for at least ten seconds, at a preheating temperature that is lower than the process temperature and higher than a condensation temperature of the oxidation gas, and where the oxidation gas begins to be admitted to the heating device before the preheating temperature is reached or at the preheating temperature. The office action points to col. 3, lines 66-67 through col. 4, lines 1-42 to disclose these features. In Okase, the atmosphere of the reaction tube is heated to 800°C, the a wafer boat 5 is loaded into the reaction tube, the atmosphere of the reaction tube is heated to 1200°C, and then oxidation gas is introduced (Okase, col. 4, lines 1-7).

There is no disclosure in either Tokai or Okase directed to holding the temperature in the heating device for any duration of time, let alone for at least ten seconds. Neither is there a disclosure in either Tokai or Okase of beginning to introduce the oxidation gas on or before the preheating temperature is reached. In Okase the oxidation gas is not introduced until the 1200°C temperature is reached (Okase, col. 4, lines 3-6). If the 1200°C is relied upon to disclose the preheating temperature, then Okase does not disclose a processing temperature which, according to claim 5, is higher than the preheating temperature. In addition, there is no disclosure in either Tokai or Okase of using a preheating temperature that is higher than the condensation temperature of the oxidation gas used. Accordingly, the Tokai-Okase combination does not teach or suggest the preheating features as claimed in claim 5.

The Applicant respectfully submits that Tokai does not disclose the features of claim 9. Claim 9 includes, *inter alia*, interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation of the layer as a function of the recorded oxidation width. These features allow accurate determination of parameters that are relevant for oxidation, such as the metal content of

the layer or the actual starting size of the diaphragm to be produced, which may be used to adjust the process time for subsequent oxidation of the same oxide layer. This can provide increased accuracy in achieving the desired oxidation width (See Specification, p. 7, lines 17-30). The office action refers to Figure 1 of Tokai to disclose the features of claim 9. Neither Figure 1 nor the disclosure of Tokai disclose or suggest interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation as a function of the recorded oxidation width. The addition of Okase does not cure this deficiency. Okase does not disclose interrupting oxidation before a desired oxidation width is reached, recording the oxidation width, and performing post-oxidation as a function of the recorded oxidation width. The Tokai-Okase combination does not disclose the features of claim 9.

For the foregoing reasons, the Applicant respectfully submits that claims 1 and 4-10 are not unpatentable over Tokai in view of Okase and thus requests withdrawal of the rejection of these claims under § 103(a).

Claims 2, 11, 12: 35 U.S.C. § 103(a) – Tokai-Okase-Tsuya

Claims 2, 11, and 12 are rejected as being unpatentable over Tokai and Okase in view of Tsuya (US 4,525,223).

The Applicant respectfully traverses the rejection of claims 2, 11, and 12. Claims 2, 11, and 12 each depend from claim 1. As asserted above, the Tokai-Okase combination does not disclose all the features of claim 1. The Tokai-Okase combination does not disclose introducing the substrate into a holding device, introducing the holding device in the heating device, or recording the process temperature by recording the temperature of the holding device. The addition of Tsuya does not cure this deficiency. The office action relies on Tsuya to disclose a gallium arsenide substrate, a holding device containing graphite, a thermocouple, and a laser unit. Accordingly, claims 2, 11, and 12 are not unpatentable over Tokai and Okase in view of Tsuya at least for the reasons stated above with respect to claim 1.

With respect to claim 11, the office action relies on Tsuya to disclose a thermocouple. According the claim 11, the temperature of *the holding device* is recorded using a pyrometer or using at least one thermocouple. For the reasons noted above, neither Tsuya, nor the combination of the Tokai, Okase, and/or Tsuya, disclose recording the temperature of the holding device.

For the foregoing reasons, claims 2, 11, and 12 are not unpatentable over Tokai and Okase in view of Tsuya. Accordingly, the Applicant respectfully requests withdrawal of the rejection under § 103(a).

Claims 18-20: 35 U.S.C. § 103(a) – Tokai-Okase-Weaver

Claims 18-20 are rejected as being unpatentable over Tokai and Okase in view of Weaver (US 5,411,763).

The Applicant respectfully traverses the rejection of claims 18-20. Claims 18-20 each depend from claim 1. As asserted above, the Tokai-Okase combination does not disclose all the features of claim 1. The Tokai-Okase combination does not disclose introducing the substrate into a holding device, introducing the holding device in the heating device, or recording the process temperature by recording the temperature of the holding device. The addition of Weaver does not cure this deficiency. The office action relies on Weaver to disclose a gallium arsenide substrate, a holding device containing graphite, a thermocouple, and a laser unit.

Accordingly, claims 18-20 are not unpatentable over Tokai and Okase in view of Weaver at least for the reasons stated above with respect to claim 1 and the Applicant respectfully requests withdrawal of the rejection under § 103(a).

New Claims

The Applicant adds new claims 21-22. Claim 21 is directed to a method for oxidizing a layer that includes, *inter alia*, a post-oxidation feature. In particular, claim 21 includes, *inter alia*, interrupting the heating of the substrate at a second process time, where the second process time is after the first process time; recording an

oxidation width of the layer to be oxidized; determining a post-oxidation process time as a function of the recorded oxidation width; reintroducing the holding device into the heating device; reheating the substrate to the process temperature; maintaining the reheated substrate at the process temperature for the post-oxidation process time; and recording the process temperature during the processing and during the post-oxidation by recording a temperature of the holding device. Support for these features may be found in Figure 6 and in the specification on pages 19-20.

The post-oxidation feature facilitates an identification of parameters which are critical for oxidation, e.g. the metal content of the layer which is to be oxidized or the actual starting size of the diaphragm to be produced. Such determinations may be used to adjust the process time (i.e., the post-oxidation process time) for a second oxidation time for further oxidation of the same oxide layer. In this way, the oxidation width can be set very accurately, such as to a predetermined target depth.

None of the asserted references disclose, either alone or in combination, the post-oxidation features of claim 21. Claim 22 depends from claim 21. The Applicant accordingly requests allowance of new claims 21-22.

Conclusion

The Applicant adds new claims 21-22 and respectfully traverses the rejection of claims 1-12 and 18-20. The Applicant respectfully submits that the pending claims are in condition for allowance. The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Respectfully submitted,



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